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EXAMINER

TSANG FOSTER, SUSY N

ART UNIT PAPER NUMBER

1745

DATE MAILED: 01/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

10/046,918

Applicant(s)

SHIBATA ET AL.

Examiner

Susy N Tsang-Foster

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 2, 12, 13, 16-26, 28, 30 and 32-35 is/are withdrawn from consideration.
- 5) ☒ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3-11, 14, 15, 27, 29 and 31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 1/17/2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.

- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-32 in Paper No. 7 is acknowledged. The traversal is on the ground(s) that the restriction is improper because it divides a product and its method of production and that irrespective of the invention to be elected, both areas would need to be searched and that a single inventive concept is present. This is not found persuasive because the criteria for a proper restriction relating to product and method of making the product are that the product and method of making the product must be patentably distinct and that there is serious burden to search both the product and the process of making the product (see MPEP 803).

MPEP 803 states:

**“CRITERIA FOR RESTRICTION BETWEEN PATENTABLY DISTINCT
INVENTIONS**

There are two criteria for a proper requirement for restriction between patentably distinct inventions:

- (A) The inventions must be independent (see MPEP § 802.01, § 806.04, § 808.01) or distinct as claimed (see MPEP § 806.05 - § 806.05(i)); and
- (B) There must be a serious burden on the examiner if restriction is required (see MPEP § 803.02, § 806.04(a) - § 806.04(i), § 808.01(a), and § 808.02).”

In meeting the first criterion above, the product and method of making the product have been shown to be patentably distinct in the previous written restriction requirement because the

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product as claimed can be made by another and materially different process (MPEP § 806.05(f)) such as sputtering the electricity collecting cathode layer or electricity collecting anode layer instead of printing or spraying as recited in the process claims.

In meeting the second criterion above, serious burden has been shown by separate classification of the product and the method of making the product. Separate classification shows that each distinct subject has attained recognition in the art as a separate subject for inventive effort, and also a separate field of search. There is no requirement to search class 427, subclass 115 when Group I, drawn to product claims is elected.

With respect to the election of species requirement, applicant elects with traverse the first species drawn to an embodiment of the single cell comprising an air electrode which comprises a cathode layer and electricity conducting cathode layer, bismuth oxide as the cathode layer and silver as the electricity conducting cathode layer. The Examiner made a typographical error and intended an election of species for the adhering cathode layer (not the cathode layer as previously written) to be selected from the group consisting of silver and bismuth oxide. The Examiner is interpreting the election of bismuth oxide species as the adhering cathode layer in light of the present claims.

The traversal for the election of species requirement is on the ground(s) that the election of species is between embodiments of a generic invention and 37 CFR 1.141 clearly provides that applicant is entitled to a reasonable number of species of the invention. In response, the species election requirement is governed by 35 U.S.C. 121. The previous election of species requirement states that applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is

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finally held to be allowable. The previous written election requirement also states that upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. Currently, there are no generic claims in the present application or any allowed generic claims. Claims readable on the elected species for the elected embodiment are claims 1, 3-11, 14, 15, 27, 29, and 31.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 2, 12, 13, 16-26, 28, 30, and 32-35 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention and/or species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 7.

Priority

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

4. The drawings are objected to because in Figure 5, the word “splayed” should be “sprayed”.

Information Disclosure Statement

5. The information disclosure statement filed on 1/17/2002 has been considered by the Examiner.

Specification

6. The disclosure is objected to because of the following informalities:

The table of Figure 6 does not show comparative examples 2 to 7 but instead shows comparative examples 4 to 7.

On page 8, line 23, “cathode layer 32” should be “anode layer 32” to maintain consistency throughout the specification.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 1, 3-11, 14, 15, 27, 29, and 31 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In claim 1, the limitation “the adhering cathode layer has a structure denser than the electricity collecting cathode layer” does not appear to be enabled by the specification.

Specifically, the specification states (see page 9) that the adhering cathode layer and the adhering anode layer should be discontinuous thin film layers and that a discontinuous thin film layer means a layer that is not a continuous thin film and not uniformly dense (see page 9).

Since the thin film layer is not uniformly dense, it is unclear how the term “denser” would

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describe an adhering electrode layer relative to the electricity collecting electrode layer since the term “denser” would not apply a layer that does not have uniform density. Furthermore, page 10 of the specification states that the electricity collecting electrode layers (22, 32) should be covered on the upper surface of the adhering electrode layers (21, 31) almost in a net form. If the electricity collecting electrode layers have a net form structure, it is unclear how what the density of the electricity collecting electrode layer would be since a net form structure is not uniformly dense.

Claims depending from claims rejected under 35 USC 112, first paragraph are also rejected for the same.

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 1, 3-11, 14, 15, 27, 29, and 31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, the limitation “the adhering cathode layer has a structure denser than the electricity collecting cathode layer” is indefinite because it is unclear what the term “denser” means for a non-uniform layer disclosed in the specification and the term is not defined in the specification.

Specifically, the specification states (see page 9) that the adhering cathode layer and the adhering anode layer should be discontinuous thin film layers and that a discontinuous thin film layer means a layer that is not a continuous thin film and not uniformly dense (see page 9).

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Since the thin film layer is not uniformly dense, it is unclear how the term “denser” would describe an adhering electrode layer relative to the electricity collecting electrode layer since the term “denser” would not apply to a layer that does not have uniform density. Furthermore, page 10 of the specification states that the electricity collecting electrode layers (22, 32) should be covered on the upper surface of the adhering electrode layers (21, 31) almost in a net form. If the electricity collecting electrode layers have a net form structure, it is unclear how what the density of the electricity collecting electrode layer would be since a net form structure is not uniformly dense.

It is unclear to the Examiner what the term “denser” means when the comparison involves two structures each with a nonuniform density.

In claim 7, it is unclear what total volume is being referred to.

Claim 27 recites the limitation "the single cells" in line 1. There is insufficient antecedent basis for this limitation in the claim. Specifically, claim 1 recites “a single cell”, not “single cells”.

Claims depending from claims rejected under 35 USC 112, second paragraph are also rejected for the same.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an

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international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

12. As best understood, claims 1, 3, 4, 7, and 9-11 are rejected under 35 U.S.C. 102(b) as being anticipated by JPO Machine Translation for JP 09-180731 A.

The JPO Machine Translation for JP 09-180371 A discloses a cell of a solid oxide fuel cell having an air electrode layer on one side of the solid electrolyte layer 30 and a fuel electrode on the other side where ceramic particles of the air electrode are made to have smaller average crystal particle size in a region 31 within 300 microns from the surface of the solid electrolyte 30 than that in a region 33 deeper than 300 microns (see JPO English abstract and paragraphs 1, 9, 10, and 14 of the machine translation).

As seen in Figure 1, the air electrode can be seen as comprising 2 layers 31 and 33. The layers 31 and 33 are both made of an air electrode active material (see Table 1 and paragraphs 16-19. The layer 31 can inherently function as the adhering cathode layer that allow the air electrode and the solid electrolyte layer to adhere electrically and mechanically to each other and the layer 33 inherently functions as an electricity collecting cathode layer that shows an electricity collecting function of the air electrode. The diameter of the particles in layer 31 may be the same or may be made gradually smaller toward the solid electrolyte layer 30 (see paragraph 23 of machine translation). The diameter of the average crystal grain of the layer 31 is smaller than the diameter of layer 33 (see paragraph 24 of machine translation) which means that layer 31 is denser than layer 33. The diameter R_s of the average crystal grain of the ceramic particle of layer 31 and the diameter R_p of the average crystal grain of layer 22 satisfies the relation $R_s/R_p = 0.05$ to 0.8 such that the polarization resistance can be reduced without losing

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the permeability of the gas in the air electrode (see paragraphs 9, 12 and 24 of machine translation). Thus, adhering cathode layer 31 also configures a three-phase interface composed of the solid electrolyte layer, reactive gas and the air electrode or a two phase interface composed of the solid electrolyte layer and the air electrode and the electricity collecting cathode layer 33 has pores providing the reactive gas to the three-phase interface or the two-phase interface. (see Figure 1 and paragraph 31 of machine translation). As seen in Table 1, the examples 2-7, 10-15, 17-22, 24-30, 32, and 34-39 show that the electricity collecting cathode layer is thicker than the adhering cathode layer. Furthermore, since the air electrode has gas permeability (see paragraph 24 of machine translation), the adhering cathode layer is inherently a discontinuous thin film layer and the electricity collecting cathode layer inherently has conductive particles forming a three-dimensional network structure (see also Figure 1).

Examples 10, 11, 20, and 32 in Table 1 shows that the adhering cathode layer comprises conductive particle material having a particle diameter of 0.5 micron or less and the electricity collecting cathode layer comprises a conductive particle material having a particle diameter of 10 microns which is greater than 0.8 microns.

The porosity of the electricity collecting cathode layer is 20 to 45 % (see paragraph 31 of machine translation).

Since the average diameter of the particles of the electricity collecting cathode layer 33 is 10 microns with a thickness of 312 microns and the average diameter of the particles of the

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adhering cathode layer 31 is 2.3 microns with a thickness of 4.3 microns in example 2 in Table 1, the thickness of 4.3 microns of the adhering cathode layer 31 is less than the average diameter of the constituent particles of the air electrode as can be shown by approximate calculations of the volume of the particles in each of the layers and the number of particles in each of the layers and then averaging the diameter of the particles in the air electrode. The volume of each of the particles in layer 33 is approximately 82 times greater than the volume of each of the particles in layer 32. However, the total volume of layer 33 is only 72 times greater than the total volume of layer 21. So the ratio of the number of particles in layer 33 is approximately $72/82$ that of layer 31 or 0.88. Assuming there are a total of 88 particles in layer 33, there would be approximately 100 particles in layer 31. A weighted average of the diameter of the particles of in the air electrode in example 2 of Table 1 would be approximately $(100 * 2.3 \text{ microns} + 88 * 10 \text{ microns})/188 = 5.9 \text{ microns}$ which is greater than 4.3 microns thickness of the adhering cathode layer.

13. As best understood, claims 1, 4, 11, 14, and 15 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Khandkar (US 5,171,645).

See col. 3, lines 45-60; col. 4, lines 32-35; col. 5, lines 34-65; col. 8, lines 36-48 and lines 60-65 of the reference.

14. As best understood, claims 1, 4-6, 11, 14, 15, and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Jankowski et al. (US 5,753,385).

Jankowski et al. disclose a single cell for a solid oxide fuel cell comprising the electrolyte layer and two electrodes (electricity collecting electrodes) and electrolyte-electrode interfaces (adhering electrode layers) (see abstract and Figure 1). Jankowski et al. also disclose stacking of the solid oxide fuel cell units through a continuous process (col. 2, lines 22-67). In a specific example, a fuel cell unit comprises electrodes 11 and 12 synthesized through the compaction of metal coated powders where the cathode is formed by cosputtering Ag and YSZ sources and the cathode interfacial layer is Y-stabilized Bi_2O_3 (col. 7, lines 50-55). Alternatively, instead of Ag, the cathode can be Pt, Pd, or lanthanum strontium manganate (col. 8, lines 22-30). The interfacial layers may be 1 to 2 microns thick and the electrodes have a thickness in the range of 1 to 750 microns (col. 9, lines 10-15). The ratio of 1 micron to 750 micron for the thickness of the cathode interfacial layer (cathode adhering layer) and the cathode (electricity collecting cathode) respectively gives 0.00133 which falls within 1/1000 and 1/500 as claimed.

15. As best understood, claims 1, 4, 6, 11, 27, 29, and 31 are rejected under 35 U.S.C. 102(e) as being anticipated by Badding et al. (US 2001/0044041).

Badding et al. disclose a solid oxide fuel cell assembly comprising a roughened interfacial layer applied to the electrolyte to improve electrode adhesion and electrical contact between the electrode and the electrolyte and the interfacial layers are preferably porous and may be of the same composition of the electrolyte structure (see paragraph 64). The interfacial layer is less than one micron in thickness (paragraph 65). The electrodes applied to the electrolyte surfaces are approximately 10-20 microns (paragraph 80).

As shown in Figure 1B, the single cells are arranged two-dimensionally to form a cell plate. A number of planar designs for solid oxide fuel cells include a cell formed by applying single cells to each side of an electrolyte sheet and then these single cells are then stacked and connected in series to build voltage (paragraph 7). Monolithic designs have a multi-celled or “honeycomb” type structure defined by combinations of corrugated sheets and flat sheets (see paragraph 7) and conventionally include cell plates with single cells arranged two-dimensionally in a honeycomb pattern that are stacked as evidenced by Aitken et al. (US 5,273,837).

16. As best understood, claims 1, 4, and 11 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Doshi et al. (US 2002/0177031 A1).

See Figure 2 and paragraphs 32 and 33 of the reference.

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. As best understood, claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Badding et al. (US 2001/0044041).

Badding et al. (US 2001/0044041) et al. disclose all the limitations of claim 8 except that the cathode (the electricity collecting cathode layer) is coated on the interfacial layer (adhering cathode layer) in approximately in a net fashion.

Badding et al. teach that the geometry of electrodes can be chosen to make for better use of fuel or fuel delivery and can be any shape to allow for manifolding and improved performance (see paragraph 69).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the cathode approximately in a net fashion on the interfacial layer because the geometry of the electrode can be chosen to make for better use of fuel or fuel delivery and can be any shape to allow for manifolding and improved performance.

Thus, Badding et al. is clearly teaching that the electrode geometry results effective variable. The courts have held that optimization of a results effective variable is not novel. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

19. As best understood, claims 27 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jankowski et al. (US 5,753,385) in view of Nishioka et al. (US 5,543,241).

Jankowski et al. disclose all the limitations of claims 27 and 31 except that unit cells are arranged two-dimensional to form a cell plate and layering the cell plates.

Nishioka et al. disclose that units cell of a solid oxide fuel can be arranged two-dimensionally to form a cell plate and layering the cell plates three-dimensionally to yield a high voltage fuel cell (col. 10, lines 5-32).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the units cells of the solid oxide fuel cell of Jankowski et al. two dimensionally to form cell plates and stacking the cell plates three-dimensionally to yield a high voltage fuel cell.

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20. As best understood, claims 27, 29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khandkar (US 5,171,645) in view of Nishioka et al. (US 5,543,241).

Khandkar (US 5,171,645) disclose all the limitations of claims 27, 29 and 31 except that unit cells are arranged two-dimensional to form a cell plate and layering the cell plates, or layering the single cells.

Nishioka et al. disclose that units cell of a solid oxide fuel can be arranged two-dimensionally to form a cell plate and layering the cell plates three-dimensionally to yield a high voltage fuel cell (col. 10, lines 5-32).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the units cells of the solid oxide fuel cell of Jankowski et al. two dimensionally to form cell plates and stacking the cell plates three-dimensionally to yield a high voltage fuel cell. In this three-dimensional arrangement, the single cells are also layered.


Conclusion

21. Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster, Ph.D. whose telephone number is (571) 272-1293. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (571) 272-1292.

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The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

st/ 

Susy Tsang-Foster
Primary Examiner
Art Unit 1745